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Word order and voice influence the timing of verb planning in german sentence production

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Abstract: Theories of incremental sentence production make different assumptions about when speakers encode information about described events and when verbs are selected, accordingly. An eye tracking experiment on German testing the predictions from linear and hierarchical incrementality about the timing of event encoding and verb planning is reported. In the experiment, participants described depictions of two-participant events with sentences that differed in voice and word order. Verb-medial active sentences and actives and passives with sentence-final verbs were compared. Linear incrementality predicts that sentences with verbs placed early differ from verb-final sentences because verbs are assumed to only be planned shortly before they are articulated. By contrast, hierarchical incrementality assumes that speakers start planning with relational encoding of the event. A weak version of hierarchical incrementality assumes that only the action is encoded at the outset of formulation and selection of lexical verbs only occurs shortly before they are articulated, leading to the prediction of different fixation patterns for verb-medial and verb-final sentences. A strong version of hierarchical incrementality predicts no differences between verb-medial and verb-final sentences because it assumes that verbs are always lexically selected early in the formulation process. Based on growth curve analyses of fixations to agent and patient characters in the described pictures, and the influence of character humanness and the lack of an influence of the visual salience of characters on speakers' choice of active or passive voice, the current results suggest that while verb planning does not necessarily occur early during formulation, speakers of German always create an event representation early.

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Supplemental Material

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Supplementary Material

Word order and voice influence the timing of verb planning in German sentence production

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1 Analyses of onset latencies of verbs/auxiliaries following the subject and of second NPs

Table S1: Results from linear mixed effects regression model predicting log-transformed onset latencies of verbs (V-medial actives) or auxiliaries (V-final actives, passives) following the subject

	$\hat{\beta}$	$\lvert t \rvert$	*F* statistic	*p*
Intercept	7.87	242.51		
Actives vs. Passives	0.03	1.01	$F(2, 24) = 1.55$	0.23
V-final Actives vs. V-medial Actives	-0.04	1.46		

Table S2: Results from linear mixed effects regression model predicting log-transformed onset latencies of second NP (patient in actives and agent in passives)

	$\hat{\beta}$	$\lvert t \rvert$	*F* statistic	*p*
Intercept	7.75	238.86		
Actives vs. Passives	-0.02	0.92	$F(2, 23) = 0.49$	0.62
V-final Actives vs. V-medial Actives	0.02	0.60		

2 Target stimulus pictures

* – primarily elicited V-medial active sentences; ¶ – primarily elicited V-final active sentences; † – primarily elicited passive sentences; stimulus pictures in parentheses were excluded from analysis

1 Ambulance car colliding with a woman†
2 Baker kneading bread dough*
3 Bird pulling a worm out of the ground*
4 Boxer beating a man*
5 Boy breaking branch from a tree*
6 Boy catching a frog*
7 Boy eating corn*
8 Boy kicking a football*
9 Boy kicking against a rock*
10 Boy stirring in a soup*
11 Bull attacking a girl*
12 Cat catching a mouse*
13 Cat scratching a girl's knee*
14 Construction worker losing his hat*
15 Cowboy catching a bull with a lasso*
16 Crocodile biting into a man's leg*
17 Dog chasing a mailman†
18 Dog chasing a squirrel*
19 Dog sniffing on a mandarin*
20 Frog eating a fly*
21 Gardener planting a tree*
22 Girl hanging out laundry*
23 Girl opening a door*
24 (Girl playing with a jumping rope)
25 Girl pushing a boy*
26 (Girl running towards an open door)
27 Girl tripping a construction worker*
28 Lion eating a dead zebra¶
29 Man angling a fish¶
30 Man breaking a piece of wood with a hammer¶
31 Man chopping a log of wood¶
32 Man cutting wood*
33 Man kicking against a chair*
34 Man leaving a hut*
35 Man pushing a car*
36 Man throwing a baby up in the air*
37 Monkey holding a crab in its hand*
38 Mosquito stinging a football player†
39 Mouse nibbling on a chocolate bar*
40 Nurse washing a baby*
41 Old man opening a window*
42 Old man reading a book*
43 Old woman climbing up the stairs*
44 Owl carrying a bag*
45 Paper boy selling newspapers*
46 Police officer arresting a man*
47 Police officer stopping a sports car*
48 Police officer stopping a walker-by*
49 Pupil raising his hand*
50 Rabbit eating a carrot*
51 Sailor drinking from a bottle*
52 Sheep eating leaves from a bush*
53 Soldier shooting a man*
54 Train colliding with a bus*
55 Veterinarian examining a horse's hoof*
56 Woman lifting a rug*
57 Woman looking inside a basket*
58 Woman walking across a bridge*

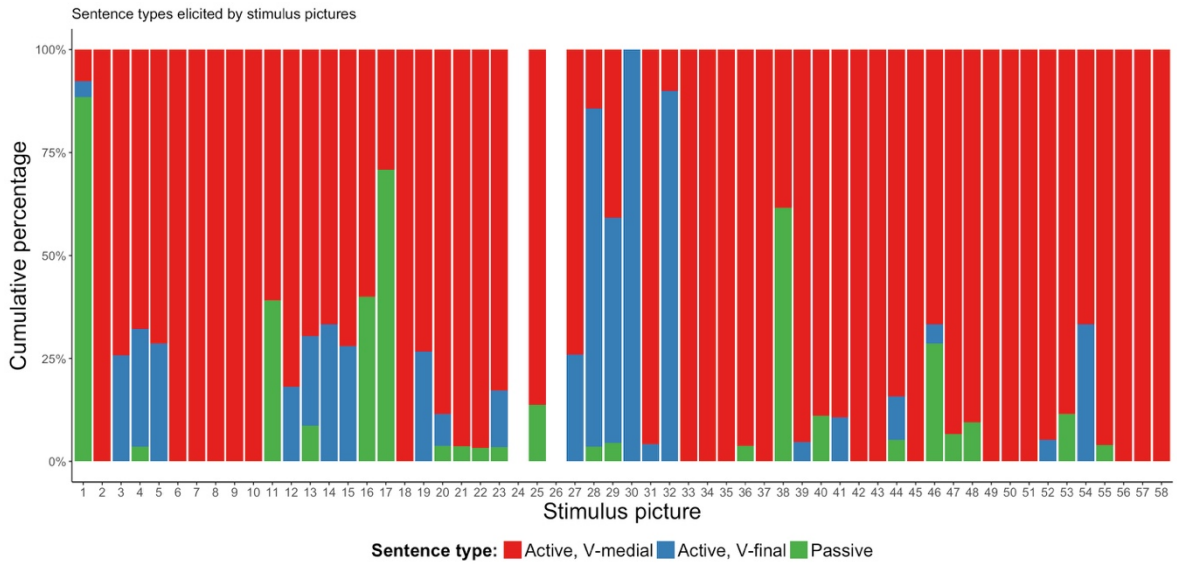

Figure S1: Proportions of sentence types elicited by stimulus pictures.

3 Proportions of fixations

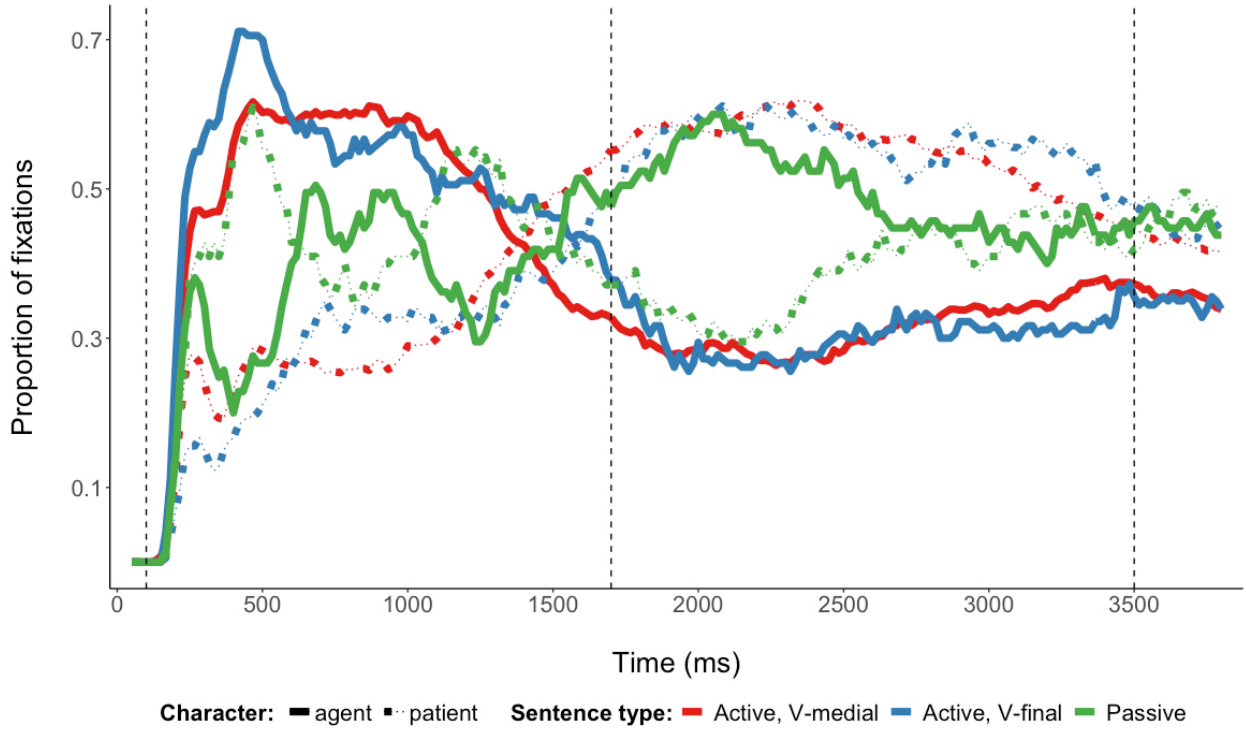

Figure S2: Proportion of fixations to agents and patients during the production of three German sentence types. Vertical lines indicate analysis time windows.

4 Model fits

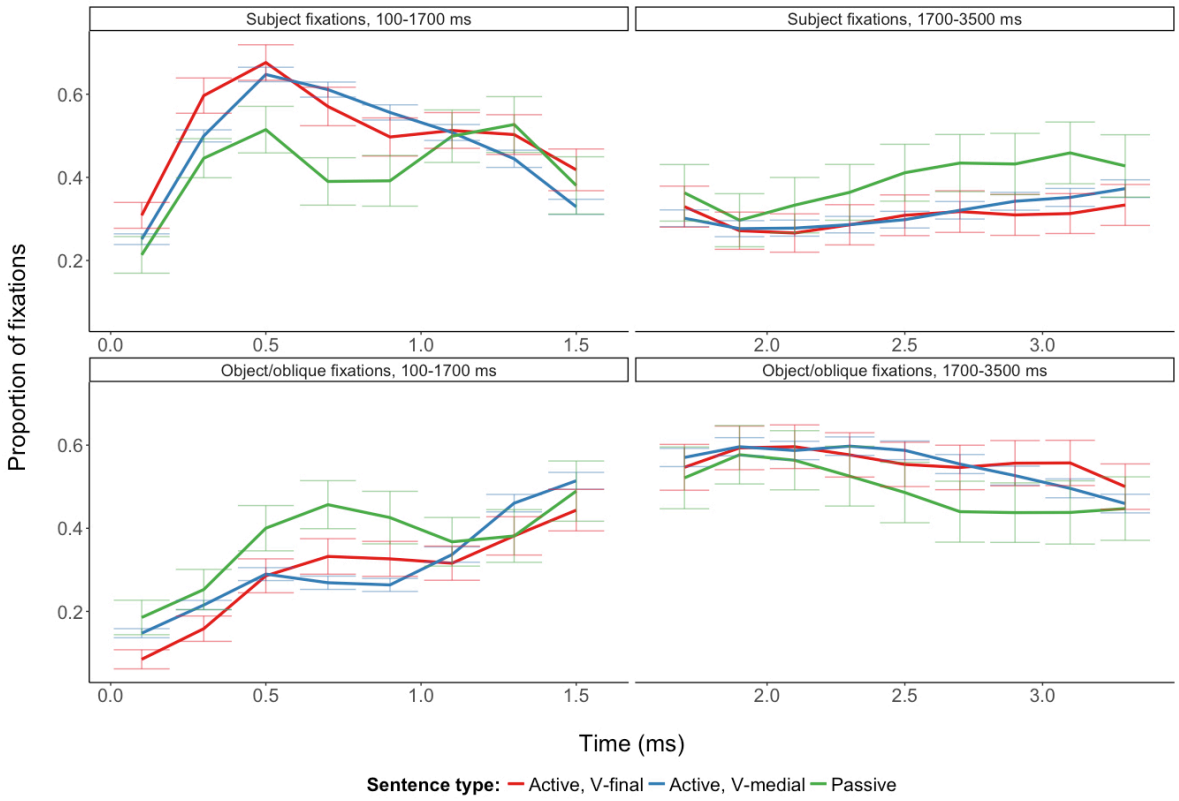

Figure S3: Mean fitted values from logistic mixed effects regression models predicting fixations on subject and object/oblique characters in three German sentence types. Error bars indicate one standard error of the mean fitted values.